Mass, Weight and Density

Mass:

Mass is the amount of matter in a body that does not change with its location or shape. Mass is a measure of the quantity of matter in an object at rest relative to the observer. The mass of a body depends on the number and composition of atoms and molecules that make up the body. The SI unit of mass is kg and g.

Mass of a body resists a change from its state of rest or motion, this is called inertia. A body resists a change in its motion due to inertia. Greater the mass greater is inertia. So that's why the heavier objects are difficult to stop when they are in motion.

Electronic Balance

Electronic balance is an apparatus used to measure mass of different objects by comparing it with a known mass.

Weight:

The weight of an object is the gravitational force, or gravity, acting on it. Since weight is a force, the SI unit is Newton (N), not the kg. Force is a vector quantity. Vector Quantities have the direction and magnitude. The direction of a weight is downward – towards the center of the earth. Weight of a body varies in different places. It depends on gravitational field strength. W=MG

If something has a larger volume, it will have a smaller mass.

A measuring cylinder is usually 1000 ml/1000cm³

Initially was 600 ml but after the rock it became 650ml. if there is an irregular object we gently place it in the displacement can.

- 650 ml full

V= 650-600

V= 50ml – 50cm³

Gravitational field: Gravitational field strength is defined as force per unit mass. It is a region in which a mass experiences a force due to gravitational attraction. It is equivalent to the acceleration due to free fall. Gravitational field on the surface of the Earth is 9.8 N/kg, m/s².

Describe how the student uses the spring balance/force meter to find the mass of the stone.

He uses the spring balance/force meter to obtain the weight of the stone. The Gravitational field on the surface of the Earth is 9.8 N/kg. He then applies the formula w = mg to find the value of the mass of the stone.

Density:

Density is how much mass is packed into a given space. The density of a substance is defined as its mass per unit volume. To calculate the density we need to know its mass m and its volume v. Density ρ is called rho. The mass is measured in kg and volume is measured in m³, the unit of density would be SI unit. However, if the mass is measured in g and volume in cm³, the unit of density would be g/cm⁻³.

As most objects used have a relatively small mass and volume the unit g/cm⁻³ is more commonly used. If the different size of object has same density means all the objects is made up of same material.

Substances that float on water have lower densities than water, whereas substances that sink have higher densities than water.

ρ = mass/volume

SI unit is kg/m⁻³

Density of a regular solid:

- Find the Mass of the solid on a balance.
- Measure the length, breath and height & calculate the
- Volume. (i.e. V = l x b x h). Calculate the Density.

Density of an irregular solid:

- Find the Mass of the irregular solid by using electronic balance.
- Add the known volume of water into the measuring cylinder and this initial volume. Put the irregular solid into measuring cylinder. Measure the volume of water and this final volume.
- Find the volume of the solid by subtracting initial volume of the water from final volume of the water. (80 − 50 = 30 cm³)
- Calculate the density of the solid using the formula: ρ = $\frac{m}{V}$

Density of a liquid:

- Find the Mass of an empty Measuring Cylinder.
- Add a certain Volume of Liquid.
- Find the Mass of the Measuring Cylinder and Liquid. Calculate the Mass of Liquid.
- Calculate Density of Liquid.
- Immiscible liquids with different densities are poured into the same container.
- Liquid with the lowest density will be at the top and highest at the bottom.

How does a heavy ship float?

A ball of steel has a greater volume than water so it sinks, whereas a ship contains large volume of air in the various rooms and cabins. Therefore we will have to consider the average density of the ship. The avg. density of an object is calculated by dividing its total mass by its total volume.

Less density floats. Oil is less dense than water so it floats. High density sinks. A steel pin has more density than water so it sinks.